4. What user acceptance research has been carried out?

A. What do travelers think of ATIS concepts, when they learn about them? What do they want from ATIS?

There have been a number of studies in which researchers have introduced members of the general public — singly or in groups — to ATIS ideas, and sought their reactions. Sometimes this has been in connection with one particular product or service concept, which may or may not have developed a "working model" that can be demonstrated, in person or on videotape. In other cases, the concepts have been presented in more general terms, or opinions solicited about how such market offerings should be designed to best meet the needs of their users.

In general, from CRA's experience and from what has been reported in the literature about this type of research, many people get excited about the prospects of certain ATIS enhancements, particularly for private vehicle travel.

> *As part of an ITS strategic planning study for the TRANSCOM consortium in the New York metropolitan region, a telephone survey of about 1,000 regular peak-period travelers was carried out.' This explored their current use of information sources regarding travel conditions, and their interest in obtaining ATIS information of various sorts. Most of the ATIS improvements presented involved pre-trip or en-route information obtained from a jiied location (at home, or at transit facilities) or by radio or telephone from within a private vehicle; relatively little emphasis was placed on enhanced in-vehicle equipment. While such a telephone survey method may be expected to produce overstatement of the respondents' interest, the very high level of support for enhanced traveler information was remarkable: 88% said that they "favor(ed) building an improved travel information system like the one discussed in this survey," and 78% indicated that they would be willing to pay something to do so. The improvements receiving most positive endorsement were those providing real-time information on the locations and extent of traffic delays, travel times using various routes, and expected arrival times for transit vehicles. Interestingly, when asked to speculate about how their travel behavior might be affected by enhanced information, for the third of this New York region sample who anticipated greater tripmaking, 82% foresaw more transit trips, compared with only 13% who foresaw making more private vehicle trips.*

Not surprisingly, priorities for various types of pre-trip and en *route* information differ between local and long-distance travelers. For private vehicle travel, people appear to see a greater utility for ATIS information for long-distance trips than they do for local trips, and a greater utility also for en route information than for pre-trip information.

The I-95 Corridor Coalition has surveyed a variety of Northeast Corridor travelers by various modes, asking them about various forms of ATIS information that they would find useful.' Here are the proportions of **long-distance** *private vehicle travelers rating different types of information as either "somewhat important" or "very important":*

	pre-trip	***en route***
weather information	*90%*	*93%*
construction information	*80%*	*94%*
traffic conditions	*74%*	*86%*
local directions	*71%*	*74%*
long distance directions	*70%*	*na*
alternative routes	*na*	*95%*

For **local** *private vehicle travelers, the proportions are smaller and the priorities are slightly different:*

	pre-trip	***en route***
weather information	*80%*	*82%*
construction information	*73%*	*86%*
traffic conditions	*71%*	*81%*
alternative routes	*na*	*84%*

For public transportation passengers, both intercity and local, en route information is again valued more highly than pre-trip:

	pre-trip	***en route***
Intercity rail passengers:		
train schedules	*88%*	*na*
train delays	*64%*	*82%*
arrival time	*na*	*88%*
Air passengers:		
confirmed schedules	*75%*	*na*
flight delays	*71%*	*na*
airline connections	*na*	*80%*
destination information	*na*	*54%*
Rail transit passengers:		
train schedules	*86%*	*na*
train delays	*65%*	*83%*
arrival time	*na*	*83%*
Bus transit passengers:		
bus schedules	*77%*	*na*
bus delays	*65%*	*85%*
arrival time	*na*	*88%*

Personal and vehicular security and convenience are two features that often resonate most immediately with respondents. "Mayday" features do not duplicate anything currently on the market, and they appeal particularly to women. The ability to locate stolen vehicles also has a quite strong appeal to focus group participants, despite the somewhat lukewarm growth (over the last 10 years or so) of products available to enable just this function.

> *ln a USDoT-sponsored project to determine what rural drivers are looking for from an ATIS system, national telephone surveys of over 1,000 respondents were used to develop an "importance ranking" of possible features or benefits." The mean respondent importance scores were for (in descending order) a mayday device, warning of rapidly approaching hazards, a signal to "wake-up" a drowsy driver, information concerning road closures and congestion, information concerning safe driving speeds under prevailing conditions, and pre-trip planning information to facilitate route selection and navigation. Other features thought to be important included the location of ATM machines, restaurants, and motels, a listing of points of interest along a given route, and information on the speed limits and regulations in local areas.*

For navigational and traffic reporting functions, there is enthusiasm among the general public which is tempered by a degree of skepticism. In both cases, these functions will only be useful to the extent that they prove to be both accurate and reliable**.** In the case of navigational information *per se,* people who make mostly local trips may not immediately see much need for assistance. They think that they know their local areas well, and routine (infrequent) navigational uncertainties — identifying the location of an unfamiliar street name, for example — can be easily resolved by consulting a map or obtaining directions. On reflection, some people realize that they make more trips in unfamiliar territory than at first they appreciate (taking children to away sports fixtures, for instance), and then begin to see a greater personal utility.

Electronic map devices can create initial concerns about being distracting, and potentially complex to use. The "heads up" nature of audio instructions provided by some navigational devices is consequently an appealing feature.

> *109 licensed drivers in the Seattle area were exposed, in small groups, to two videotaped depictions of the TravTek system (which includes a voice guidance feature).[4] One was a "how to use" tutorial; the second depicted a drive through the Orlando area using the system. After each of the presentations. the participants independently completed a questionnaire, without any group discussion. In general, the respondents rated the system both "easy to learn" and "easy to use," assigning mean scores **of** 4.35 and 4.25 respectively on a scale of zero to six. Age proved to be the only classification variable to have a significant effect on the ratings: younger drivers gave higher ratings than older drivers. After seeing the product in action in the second video, ease of learning and use scores mostly increased, to extents that varied by age and sex.*

The skepticism about traffic reporting information focuses on whether it will provide more detailed, complete, action-oriented, or timely information than that available, at zero incremental cost, from traditional sources, primarily radio stations. To the extent that the information meets these criteria, people respond very positively to the concept. The provision of traffic-sensitive route guidance is viewed as a significant service increment over simple traffic reporting.

> *In research designed to aid the development of an ATIS component ("Genesis") for the Minnesota "Guidestar" ITS initiative, focus groups of Twin Cities' travelers were undertaken to learn what potential users thought were the most important features of a system to be based around personal communications devices.[5] It was found that the key issue for participants was unanticipated travel delays caused by accidents, bad weather, and construction. Drivers felt the core information that needed to be conveyed included the precise location and time of bottlenecks and accidents, what lanes were affected, realistic estimates of the delay time, and guidance on alternative routes. More general information about road and weather conditions were also felt to be valuable.*

There has been some qualitative research of a similar nature among business occupational groups expected to have above-average use for in-vehicle navigational and route guidance information (such occupations as real estate agents or delivery staff). As might be expected, business people tend to be more interested in the navigational and delay avoidance capabilities — allowing the driver to keep appointment schedules and communicate ahead if problems arise — and less interested in security features than are the people making mostly non-work trips.

The lowest interest levels concerning the capabilities of ATIS devices in private vehicles are reported for features that overlap with currently available technologies: general communications features, for example, which may replicate (sometimes less flexibly or completely) the capabilities of mobile telephones, or "yellow pages" types of information to direct one to (say) the nearest ATM, restaurant, or filling station.

B. What have researchers learned from analyzing existing behaviors that can help forecast what travelers might do with ATIS?

Route choice decisions made by private vehicle users have been the focus of most current work on *existing* travel behavior that may have strong implications for the ways in which travelers respond to ATIS information. There are two reasons for this. First, of all existing travel choices, route choice has been arguably the least studied historically, and is consequently the least well understood.[3] Secondly, there is some evidence that the primary use for *currently-available* forms of travel information is to make route adjustments.

> *Respondents to the TRANSCOM strategic planning telephone survey were asked whether, in the preceding twelve months, they had ever changed their intended form **of** transportation, departure time, or route as the result of receiving information of various types. For highway-related information, changes of route had been more common than either mode or departure time adjustments.'*

The frequency of making a trip appears to have a major influence on adaptive routing behavior. For frequent trips, "habit" can affect behavior:

> *For a period in the early 198Os, the toll on the Golden Gate Bridge was increased to $2 per automobile on Fridays and Saturdays, while remaining at $I on other days **of** the week. Researchers at George Mason University, analyzing time series traffic data, found evidence that this caused little time switching (people working shorter work weeks, for instance), and that some people who sought alternatives for the high toll days extended that behavior to other days as we11.*[6]

There are also differences in behavior depending on whether relevant information on traffic conditions is received before starting the trip or while *en route.* There are certainly differences related to the driver's perception of the *likely accuracy* of the information.

> *University of California researchers undertook two waves of computer-assisted telephone interviews, working with an initial sample of over 940 morning commuters in the Los Angeles area, to study (i) who was most likely to seek out radio traffic information, and (ii) how the acquisition and use **of** such information affected routing decisions.* [7] *The responses were analyzed in part by developing discrete choice models for various behaviors. When a traffic incident was reported on a respondent's regular commuting route, (s)he was more likely to stay on the route than to divert, whether or not (s)he had received the information. if information was received before beginning the trip, this offered the opportunity to*

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3 The existing travel forecasting models assign projected vehicle trips to routes essentially by assuming that drivers seek to minimize travel times, and they reallocate trips essentially randomly among competing routes when projected flows approach the capacity of a highway link,

make major route adjustments, whereas en route information is more likely to lead to only a minor local deviation around the immediate location of the problem.

The people most likely to acquire radio traffic information include those who believe most in its accuracy, those whose trips face the most variable traffic conditions, and women. The probability of making route adjustments was higher for the drivers with longer trips, those who believe the information to be accurate, those with the most variable conditions, and for better educated drivers. Women were less likely than men to divert, as were people passing through unfamiliar areas or neighborhoods thought to be unsafe.

Northwestern University researchers undertook a stated preference study ***of*** *route switching behavior in response to traffic information, using a mail-back survey asking respondents how they would react to specific hypothetical delay situations.' They found that commuters would be most willing to divert when the alternate route was a familiar one, when the driver was under time pressures, when the congestion was a non-recurring rather than a chronic problem, and when the information was "validated" by a radio report rather than relying wholly on personal observation.*

At least one study has been less concerned with pinning down the behavioral response to ATIS information than with identifying likely differences among various categories of drivers. In this and other studies **there are strong hints that sex may be a significant market segmentation variable,** a conclusion that will not be surprising to those who hold that men are much less likely to "ask the way" than are women.

A mail-back survey was conducted of some 4,000 Seattle drivers intercepted at ramps of the 1-5.[9] *The questionnaire asked about route familiarity, schedule flexibility, travel preferences, and whether pre-trip or en route traffic information had ever made the respondent change an aspect of his or her trip. Cluster analysis was conducted of the reported propensity to make changes, and four groupings were identified: "non-changers", "pre-trip changers", "route changers", and "route and time changers". Over 75% of the sample had made changes of one sort or another. Demographically, the non-changers and the route changers were quite similar to each other, as were the other two groups. However, the pre-trip changers and the route and time changers had significantly more females and younger people than the other two groups. Also, even the non-changers appreciated receiving traffic information, even* ***if*** *their travel behavior was not influenced by it.*

Because of the obvious practical difficulties of obtaining detailed (decision by decision) information about route choice behaviors, most analysis of *behavioral* information is for frequent commuting trips. Some studies, like the Northwestern University one, use *stated preference* responses to hypothetical situations, while a few studies attempt to simulate route choice situations in the laboratory.

In Japanese laboratory simulations, 40 participants made choices between two possible routes from a single origin to a single workplace, departing at a common time.[10] *As a result of their collective choices, the experimenter used a speed/flow* *function to tell each participant privately how long "that day's" journey took. Participants then each predicted the travel time for the next day's journey, and chose their routes accordingly. This process was repeated through some 20 "days" — that is, repeated iterations of the learning about the last travel time, predicting the next travel time, and choosing a route. Different experiments varied the amount of historical information given to the participants, and whether or not they were allowed to keep their own records. The results of this simulation suggest that improved information can help bring flows towards equilibrium faster. They also suggest that accuracy in predicting the travel time is inversely correlated with the propensity to switch routes.*

Some of the route choice research has specifically explored the potential impacts of having additional information of a sort that would be made feasible by various ATIS concepts.

Three academic researchers have undertaken theoretical analysis of a simple case of commuters choosing between two routes on the basis of pre-trip information.[11] *Both routes have bottlenecks whose capacities vary at random. Travelers can also use the information to change their departure times, but there is assumed to be some disutility in arriving at work before or after the desired arrival time. With a numerical example and a mathematical proof, the authors show that not only will there be individual user benefits from the pre-trip information but, with perfectly accurate information available to all of the commuters, there will also be system benefits — that is, total travel time reductions — by comparison with the "no information" case.*

One of the issues addressed by this type of research has been the levels of ATIS penetration at which user (and system) benefits might be maximized. At low penetration, drivers receiving reliable route guidance should benefit from being able to "outsmart" the drivers without it. As the penetration increases, this advantage is reduced, particularly if the system(s) being used compute individual user optima rather than a global optimization of traffic. Two theoretical studies based on network analysis methods have concluded that **diminishing returns for individual users may be experienced before the private vehicle fleet is uniformly equipped with ATIS capabilities.**

Researchers at the University of Texas simulated the effects of an in-vehicle ATIS that receives updated information at each intersection.[12] *The researchers assumed that drivers had a threshold travel time saving, below which they would not divert from their routes. When this threshold is low — that is, when travelers switch routes to save even a marginal amount of travel time — total time savings are maximized if about one-quarter to one-half of all drivers receive the information. At higher penetration levels, over-reaction to the information will cause congestion on alternate routes. At the other extreme, if the diversion threshold is very high, there will be little or no diversion. Under more moderate levels of driver response to the information, the model suggests that total travel time savings could continue to be realized up to the point where every driver has an ATIS, although most of the benefits to both users and nonusers occur when half or fewer drivers are receiving the information.*

> *Researchers at MIT examined the effects of using different algorithms in forecasting network travel times to provide in-vehicle information,[13] in an attempt to maintain travel time benefits with increasing ATIS penetration levels. However, given a limited number of roadside beacons to transmit updated traffic information to the in-vehicle units, these researchers observed a similar relationship between travel time savings and the share of vehicles receiving information as did the Texas study.*

These theoretical network studies suggest several conclusions, at least about ATIS routing information designed to optimize the individual user's route:

- **It may not be necessary to have high penetration levels of in-vehicle ATIS in order to observe most of the travel time-related benefits to users and the highway system.**
- Because of diminishing individual benefits from acquiring an in-vehicle device as penetration grows, there may be a natural incentive for "late adopters" never to acquire the ATIS capability — that is to say, market equilibrium may be at less than full market penetration.
- **As market acceptance of this form of ATIS grows, so must the quality of the information —** for example, in terms of its ability to be based on global rather than user optima, its geographic scope, or its update frequency — or the additional features (safety functions, for example, or motorist services information) that the in-vehicle unit can fulfill.

In driving simulation tests, researchers have found that, **as a driver's personal familiarity with the road network increases, he or she becomes less likely to accept advice** from an external source. Other work has focused on how people respond to receiving inaccurate information. Not surprisingly, they are less likely to use information if they have found it to be bad in the past, and measures of their trust in the information source also decrease. However drivers will often continue to use the information, and their trust increases when inaccurate information is followed by what proves to be accurate information.

C. What do people who have used ATIS have to say about their experiences?

The ongoing program of operational tests has exposed samples of the general public to using various forms of advanced traveler information in a variety of different contexts. Information from the evaluation of some tests is beginning to become available. The ATIS operational tests that are most open to the general public, and for which participation requires the lowest level of personal engagement or expense, are those providing high quality traffic information by telephone. It appears that **users can perceive a quality differential by comparison with the traffic information that they obtain from the general broadcast media, but wish that the telephone service would provide greater guidance about route diversions.**

> *Telephone surveys were conducted with representative samples of the SmarTraveler system that has operated in the Boston metropolitan area since January 1993.*[14] *Respondents were asked about the sources of traffic information that they use, and were asked to rate several attributes of each source on a ten-point scale. Overall, four-fifths of the SmarTraveler users were "very satisfied" with the service (scores of 8 or higher), and the users on average rated the SmarTraveler information more highly than alternative sources on every characteristic questioned: coverage of routes, accuracy, time of availability, and frequency of update. Also, the SmarTraveler users were more satisfied with their service than were the users of radio and TV information. [The method employed to sample users — intercepting them as they called in to the system — may account in part for these higher satisfaction scores, likely to have been produced by positive response biases]. However, SmarTraveler users were disappointed by the lack of guidance regarding alternate routes; the service does not provide such guidance because of legal and jurisdictional considerations.*

There is evidence from other operational tests that travelers do indeed **find high quality traffic and travel information to be useful, and would appreciate more types of information and its more widespread promulgation.**

> *In one component of the Travlink study in Minnesota, 150 people were recruited, from nine Twin Cities' businesses, to examine travel information from an on-line source.*[15] *During the first month of the study, the 150 recruits made almost 1,400 on-line requests. Participants reported that they were sharing the information with their colleagues, and thought that the Travlink project should get more businesses involved. The most popular data requested were traffic and construction information. Bus riders used real-time bus arrival information when that was available. The most requested potential improvements were for more extensive traffic and bus arrival information, and more trip planning features (possibly including more detailed bus connection information). While some features of the existing software were largely ignored, participants expressed an interest in enhanced mapping and printing capabilities.*

A separate Travlink initiative placed travel information kiosks in malls, major businesses, and transit transfer locations. The kiosks in transit locations were heavily used, although they did not offer real-time bus arrival information. As with the on-line participants, kiosk users requested traffic information most often, and used the features with static text menus least often.

Most of the information in the public domain concerning customer acceptance of, and operational experience with, in-vehicle navigational and route guidance devices comes from the *TravTek* operational test. Between March 1992 and March 1993, 100 Avis rental cars in Orlando were equipped with devices that could provide traffic congestion information, motorist services ("yellow pages") information, tourist information, and route guidance. There were three different configurations of the equipment. One provided motorist services only, the second provided static route guidance (with no real-time information about traffic conditions), and the third provided dynamic route guidance.

The evaluation included three studies:

- A "*yoked* driver" study, in which three drivers drove vehicles with each of the three unit configurations between selected origins and destinations at two-minute intervals under congested conditions.
- *The Orlando Test Network* study, in which drivers examined the possible display configurations in a sequence of three trips during off-peak hours. In this study, participants were assigned to cars with or without the voice guidance feature. During the test trips, each participant used no visual display for one trip and a detailed route map display for the other trips. Researchers monitored that the correct configuration was being used, and recorded the time taken for different components of the trip and the numbers of "wrong turns" made.
- The Camera Car study, in which a car specially equipped with four video cameras was used to monitor driver performance and workload.

A total ***of*** *134 women visitors and 878 men visitors received training to use the TravTek device before picking up their rental cars at Orlando International Airport.*[16] *On returning the car, the participants were asked to rate several features of the equipment on a six-point scale. There were no statistically significant differences between the three configurations regarding reported ease of use. The mean rating scores were*

motorist services only	*5.15*
static route guidance	*5.18*
dynamic route guidance	*5.24*

All users gave high ratings (with a mean score of greater than 5) to the legibility of the display text, attractiveness ***of*** *the screen colors, and the ease* ***of*** *understanding the information. Not surprisingly, the ratings differed most between the configurations when navigational and route guidance were being considered:*

"TravTek helped me find my way"

motorist services only	*3.15*
static route guidance	*5.16*
dynamic route guidance	*5.29*

" TravTek helped save time in reaching destinations"

motorist services only	*2.45*
static route guidance	*4.52*
dynamic route guidance	***4.60***

"TravTek helped me drive more safely"

motorist services only	*2.32*
static route guidance	*3.90*
dynamic route guidance	4.01

As well as achieving high satisfaction ratings in the opinion survey of users, the TravTek observational studies provided more objective quantification of some of the user benefits.

In the Orlando Test Network study, route planning for trips using TravTek features took between one and two minutes on average, compared with slightly over seven minutes for the control group (with no voice guidance and no display).[17] Trips guided by TravTek were completed in an average of about 22 minutes driving time, compared with about 27 minutes for the control group. All unit configurations except one resulted in less than one wrong turn per trip, on average (the range was about 0.80 to 0.95). The exception was the map display without voice guidance, with which drivers made an average of 1.3 wrong turns per trip.

In a privately-funded study,[18] J.D. Power & Associates recruited a total of 170 drivers in three cities (Whittier, CA, Chicago, IL, and Garden City, NY) to use a navigational system ("GuideStar") in a private automobile. The device featured navigational capabilities, including static route guidance, and "electronic yellow pages" databases. The device also offered voice prompts, but did not incorporate real-time traffic information. The primary purpose of the study appears to have been to determine what level of navigational (and services directory) detail, and what product features, would be of most value to users.

The participants — all of whom spent two or more hours in their vehicles on business travel on a normal workday (not counting commuting time), and had cellular telephone bills of at least $50 per month — each had a lo-minute test drive and two days' subsequent use of the vehicle. They were interviewed before and after using the system. As for TravTek, the participants were enthusiastic about their experience, and the enthusiasm grew with greater familiarity.

A factor analysis was undertaken of the participants' expressed satisfaction with the system. J.D. Power identified five factors. In descending order of their contribution to the level of satisfaction, these were

- *the "utility value," accounting for 53% of the variation in satisfaction;*
- *the "point of interest variety" (23%);*

- *the "user interface" (10%);*
- *the "theft potential" (9%); and*
- *the "distraction potential" (5%).*

The "utility value" factor comprised such considerations as productivity, convenience, sense of safety, ease of use, and accuracy. The "point of interest variety" was concerned with the variety and selection in listings of points of interest that the system could provide.

Participants said that the primary advantages to owning such a system were convenience, time savings, the ability to replace maps, and eliminating the need to ask for directions. After their two-day experience, they noted lower stress and higher driving confidence. The primary disadvantages were the expense, the theft potential, driver distraction, and system operational issues (including limitations in the geographical scope of the information).

D. What are customers willing to pay for ATIS information and hardware?

As always, behavioral ("revealed preference") evidence is the strongest — and, we believe, the only credible, currently available — evidence about customer willingness-to-pay. Naturally, the behavioral evidence is still quite limited, since the number of available ATIS market offerings is slender.

A number of opinion surveys have also explored willingness-to-pay issues. However, as far as we can see (the published reports are not always explicit about the questions asked), *all* of these efforts have tried to ascertain willingness-to-pay by asking ***direct questions*** about the matter, such as *"How much would your household be willing to pay for...?"* or *"Would you be willing to pay x for... .?"* Such direct questions are notorious for producing response biases. The mean WTPs estimated from asking questions like these will usually be significantly higher — to variable and unpredictable extents — than are WTP estimates derived from analysis of consumer *behavior.* While we report some direct question findings in this section, **we must caution that we do not believe that their absolute values (as distinct from their *relative* values) have much practical utility at all.**

But first, the more believable behavioral evidence. Some marketplace offerings have not represented a sufficiently different service from competing products or services that their price differential was sustainable in the market.

> *In the San Francisco Bay area, travelers had several options for receiving up-to-date traffic information: the broadcast media, a telephone hot-line, and two in-vehicle receivers.[19] The Fastline telephone hot-line offered pre-recorded messages, updated every ten minutes during peak traffic periods, accessed using a touch-tone menu of eleven choices. There was no direct user charge for accessing Fastline (just normal telephone call charges), but the system was financed in part by carrying advertising.*
>
> *One in-vehicle receiver option was Way-to-Go, a personal pager-based service, started in 1993. Customers initially had to pay a $200 capital cost for the unit, and a service subscription of $15 per month. Users entered their origin and destination on a touch pad on the pager, and received a voice response tailored to their individual trip.*
>
> ***Autotalk*** *was another in-vehicle device, introduced in 1992. This was a $129 radio and TV audio receiver which was also capable of receiving, at no additional cost, the auxiliary audio (SAP) channel of a local television station. This channel providedfrequent traffic updates (obtained from the same supplier as that for Way-to-Go) which would interrupt any other program being received by the unit.*
>
> *Although Way-to-Go offered trip-specific information, sales were sluggish compared to those for the Autotalk receiver. Autotalk provided less specific traffic information, but with no marginal use charges, and commuters may have seen*

additional value in being able to receive the audio portion of TV programs while driving. Even after the Way-to-Go pager price was reduced to $99, at most 100 units were sold in total at this price. The company went out of business two years after first offering the product.

A nugget of further behavioral evidence comes from pricing changes for the SmarTraveler telephone hot-line service in the Boston area. It appears that, despite evidence (that we will review later) of a *reported* willingness-to-pay for such hot-line services, demand for the current market offerings is quite price-sensitive:

*Until July 1995 (except for a free one-month promotional period during 1993) Cellular One mobile phone customers were charged normal air-time rates **for** their calls to SmarTraveler, while NYNEX Cellular customers were able to call SmarTraveler without charge. Cellular One callers had historically made up a small share **of** the volume **of** SmarTraveler calls, except during the October 1993 promotion period when their volume reportedly shot up (by over 100%). After the free promotion, calls from Cellular One returned to the same level as before the promotion. Between April and December 1994, only 4% of calls to the ATIS were made by Cellular One subscribers.*[20]

Moving on to the currently-available *stated preference* evidence, we would probably place greater credence in WTP estimates that come from respondents who have had first-*hand experience* in using ATIS information over those from more general projective surveys. The most detailed information of this sort comes from the debriefing interviews with TravTek users.

The purported willingness-to-pay for the capital cost of the TravTek system with either static or dynamic guidance, in response to direct questions, averaged about $900.[21] *The survey responses suggested that there would be a steep decline in interest in purchasing the unit as the price increasedfrom $700 (over 80% **of** the sample said they were willing to purchase) to around $1,200 (less than 30% **of** the sample). The median claimed WTP was about $1,000. As far as can be judged from this source, the questionnaire said nothing about continuing operating costs, which implicitly may have been taken by the respondents to be zero. The mean purported WTPs for individual features of the TravTek system were about $400 for navigation, $400 for route guidance, $300 for up-to-date information, and $200 for motorist services and tourist information.*

The J.D. Power study also asked some willingness-to-pay questions for the navigational device used in that study.

By a four-to-one margin, the J.D. Power participants preferred that the device be factory-installed rather than bought in the after-market.[18] *When asked to estimate the retail cost of such a device, the mean estimate was about $1,000 for a factory-installed system and about $900 for an after-market system. The participants were asked their likelihoods of purchasing the device at their estimated prices. Likelihood of purchase did decrease as the expected prices increased. About 74% of respondents said that there was at least some likelihood of their purchasing the* *device at their estimated prices if it were factory-installed; only 55% gave the same response for an after-market system (at the respondent's estimated price for an after-market system). These proportions were quite similar after both the IO-minute and the two-day tests, but after the two days' experience some people moved themselves from the "somewhat likely" to the "very likely" category.*

In the survey of SmarTraveler users, there were some questions about the respondent's projected usage at increased price levels. Since the calls were currently free for NYNEX cellular phone users (who made about half of all the calls) and were a local call for "land-line" callers, there is likely to be strategic bias in the answers to questions about imposing a charge. Respondents are very likely to have overstated the impact of price increases on their use of the system, so as to reduce the incentive to increase prices.

If SmarTraveler were to impose a fee of 10 cents per call, NYNEX cellular users said they would reduce their calls by 3590 while land-line callers anticipated an 18% reduction. At 50 cents per call, NYNEX patrons said they would make 71% fewer calls, land-line callers 5890 fewer calls. The prospect of monthly subscriptions, to cover unlimited calls, was also explored. Here are the proportions of users who said that they would subscribe for a given monthly fee:

	NYNEX cellular	***land-line callers***
$5 per month	***38%***	***24%***
$25 *per month*	*5%*	***3%***

Finally, there are a number of surveys in which respondents were asked a variety of direct questions about willingness-to-pay for various ATIS concepts without necessarily having any direct personal experience of them. The absolute levels of WTP responses in these cases must be considered particularly dubious.

In the TRANSCOM survey of New York Region residents,' there were general questions about willingness-to-pay for a "travel information system like the one discussed in this survey." About 78% of the sample claimed themselves willing to pay something. On a per phone call basis, 64% would pay 50 cents per call and 4490 would pay $1 per call. On a monthly subscription basis for unlimited access, 5690 would pay $5 per month, 4090 would pay $10 per month, and 3090 would pay $15 per month.

University of North Carolina researchers undertook telephone surveys of four potential ATIS user groups in the Charlotte metropolitan area: private commuters, commercial vehicle operators, jiied-site managers, and emergency response providers." In the survey of commuters, respondents were read a brief description of ATIS and its potential benefits, and asked if they would be interested in an ATIS that could reduce their driving times. About half of the approximately 580 respondents answered affirmatively. When questioned about their willingness-to-pay, they expressed a preference for a flat monthly subscription rather than a per-use charge. The mean WTP was $14 per month across the metropolitan area, varying by jurisdiction from $4.50 per month to $18 per month.

Researchers at the New Jersey Institute of Technology developed a series of choice exercises administered to a self-selected convenience sample.[23] *The ATIS concept under test was an "incident alert system," accessed before beginning the trip. The responses to the stated preference tradeoff questions allowed the researchers to estimate a discrete choice model that was used to forecast the volume of subscriptions under different system configurations. With no charges to the users, about 7990 of the sample would subscribe if the system only gave incident location information. The improvement to this baseline system that would attract most additional subscribers would be alternative route information. For the most extensive system — incident locations, alternative routes, expected delays, and transit schedules — 4290 claimed that they would pay a $5 per month subscription and 7890 would pay $2 per month.*

1 Peter Harris & Carolyn S Konheim (1995), "The Public's Interest in and Willingness to Pay for Enhanced Traveler Information as Provided by IVHS in the New York Metropolitan Area", unpublished mimeograph, New York (NY): Peter Harris Research Group.

2 Antoine Hobeika, R. Sivanandan, Karen Jehanian, & Mary D Ameer (1995), "ATIS User Needs in the I-95 Northeast Corridor", unpublished mimeograph.

3 Mohsen Zarean, R. Sivanandan, & Davey Warren (1994?), "Rural ATIS: Assessment of User Needs and Technologies", bibliographic details forthcoming.

4 John L Campbell, Rhonda A Kinghorn, & Barry K Kantowitz (1995?), "Driver Acceptance of System Features in an Advanced Traveler Information System (ATIS)", unpublished mimeograph, Seattle (Wash.): Battelle Human Factors Transportation Center.

5 Gary M Silverman & Michael Sobelewski (1994?), "IVHS Market Analysis. Minnesota Guidestar' s Project Genesis. A Case Study", unpublished mimeograph.

6 Jonathan L Gifford & Scott W Talkington (1994), "Demand Elasticity Under Time Varying Prices: A Case Study of the Golden Gate Bridge", *Proceedings of the 1994 Annual Meeting of IVHS America*.

7 Mohamed A Abdel-Aty, Ryuichi Kitamura. & Paul P Jovanis (1995) "Understanding the Effect of ATIS on Commuters' Route Choice Decisions", unpublished mimeograph.

8 Asad J Khattak, Frank S Koppelman, & Joseph L Schafer (1993), "Stated Preferences for Investigating Commuters' Diversion Propensity", ***Transportation 20,*** no. 2.

9 Loveday Conquest, Jan Spyridakis, Mark Haselkorn, & Woodrow Barfield (1993), "The Effect of Motorist Information on Commuter Behavior: Classification of Drivers into Commuter Groups", ***Transportation Research lC,*** pp. 183-20 1.

10 Yasunori Iida, Takamasa Akiyama, & Takashi Uchida (1992), "Experimental Analysis of Dynamic Route Choice Behavior", ***Transportation Research* 26B,** pp. 17-32.

11 Richard Arnott, Andre de Palma, & Robin Lindsey (1991), "Does Providing Information to Drivers Reduce Traffic Congestion?", ***Transportation Research* 25A,** no. 5.

12 Hani S Mahmassani & R. Jayakrishnan (1991), "System Performance and User Response Under Real-Time Information in a Congested Traffic Corridor," ***Transportation Research* 25A,** no. 5.

13 Haris N Koutsopoulos & Haiping Xu (1992), "An Information Discounting Routing Strategy for Advanced Traveler Information Systems," ***Transportation Research* lC,** no. 3.

14 Larry Englisher, David Koses, Susan Bregman. & Alicia Powell Wilson (1995), "User Perceptions of the SmarTraveler ATIS," unpublished mimeograph.

15 Marilyn Remer (1995), "Early Usage of On-Line and Kiosks for Travlink," unpublished presentation material.

16 William A Perez, Rebecca Fleischman, Gary Golembiewski, & Deborah Dennard (1993), "TravTek Field Study Results to Date", ***Proceedings of the 1993 Annual Meeting of IVHS America.***

17 Vaughan W Inman, Rebecca N Fleischman, Thomas A Dingus, & Chin H Lee (1993), "Contribution of Controlled Field Experiments to the Evaluation of TravTek," ***Proceedings of the 1993 Annual Meering of IVHS America.***

18 J.D. Power & Associates (1995), ***Navigation Technologies Marker Validation Study,*** Torrance (Cal.): J.D. Power & Associates.

19 Jane E Lappin, Suzanne M Sloan, & Robert F Church (1994), "A Market Analysis of the Commercial Traffic Information Business," Cambridge (Mass.): US Department of Transportation, Voipe National Transportation Systems Center.

20 Larry Englisher, David Koses, Susan Bregman, & Alicia Powell Wilson (1995), "User Perceptions of the SmarTraveler ATIS," unpublished mimeograph.

21 William A Perez, Gary A Golembiewski, & Deborah Dennard (1993), "Professed Willingness to Pay for TravTek Features," IEEE/IEE Vehicle Navigation & Information Systems Conference, Ottawa.

22 Kent N. Gourdin & Patricia E. McIntyre (1992), "Demand for IVHS in Charlotte, North Carolina: A Marketing Study," ***Transportation Quarterly 46,*** no. 2.

23 W. Patrick Beaton & Amit Sadana (1994), "The Demand for and the Change in Commuting Behavior Attributed to the Use of a Corridor Specific ATIS Pre-trip Incident Alert System," ***Proceedings of*** the ***1994 Annual Meeting of IVHS America.***